Demonstration of ISCO Treatment of a DNAPL Source Zone at Launch Complex 34 in Cape Canaveral Air Station

Final Innovative Technology Evaluation Report

Prepared for

The Interagency DNAPL Consortium:

U.S. Department of Energy
U.S. Environmental Protection Agency
U.S. Department of Defense
National Aeronautics and Space Administration

Prepared by

Battelle
505 King Avenue
Columbus, OH 43201

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Appendix B

Hydrogeologic Measurements

B.1 Performance Monitoring Slug Tests

Slug tests were performed on well clusters BAT-3, BAT-5, and BAT-6 within the in-situ ISCO plot for pre-demonstration, post-demonstration, and the extended monitoring activities. Pre-demonstration tests were completed in August 1999, post-demonstration tests were completed in August 2000, and extended monitoring tests were completed in February 2001. Bat-5 was included because BAT-3S was unavailable during pre-demonstration activities due to the installation of the oxidation system equipment. The tests consisted of placing a pressure transducer and 1.5-inch-diameter by 5-ft-long solid PVC slug within the well. After the water level reached an equilibrium, the slug was removed rapidly. Removal of the slug created approximately 2 ft of change in water level within the well. Water level recovery was then monitored for 5-10 minutes using a TROLL pressure transducer/data logger. The data was then downloaded to a notebook computer.

The recovery rates of the water levels were analyzed with the Bouwer (1989) and Bouwer and Rice (1976) methods for slug tests in unconfined aquifers. Graphs were made showing the changes in water level versus time and curve fitted on a semi-logarithmic graph. The slope of the fitted line then was used in conjunction with the well parameters to provide a value of the permeability of the materials surrounding the well. The results show a good agreement between the replicate tests.

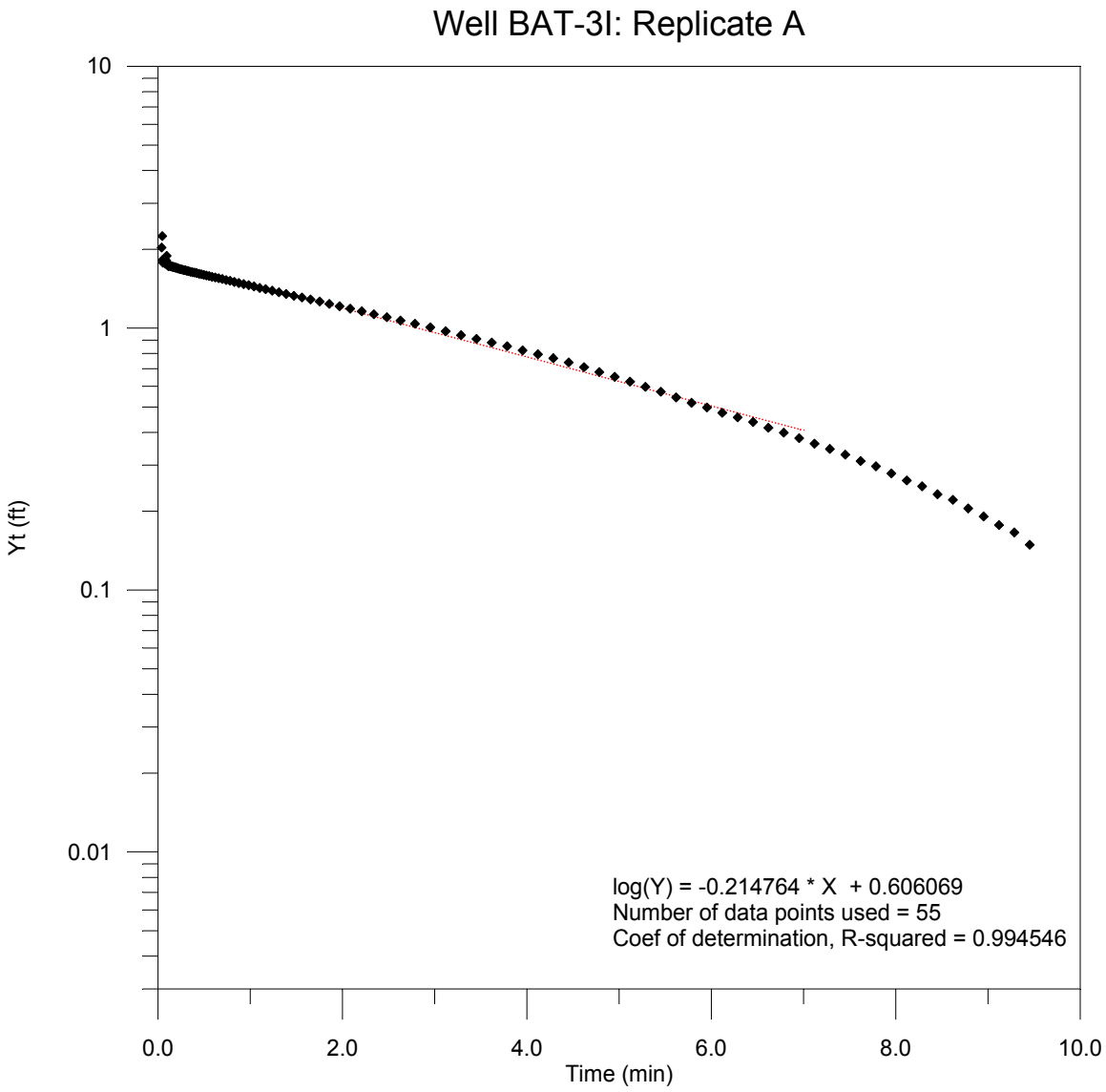
The tests are subject to minor variations. As such, a change of more than a magnitude of order would be required to indicate a change in the permeability of the sediments. Keeping this in mind, the tests showed a negligible change in permeability in most wells as shown on Table 1. The tests in wells BAT-3D and BAT6S may have increased substantially in permeability; although, the response to the slug was poor in these wells.

Table B-1. Slug Test Results in ISCO plot.

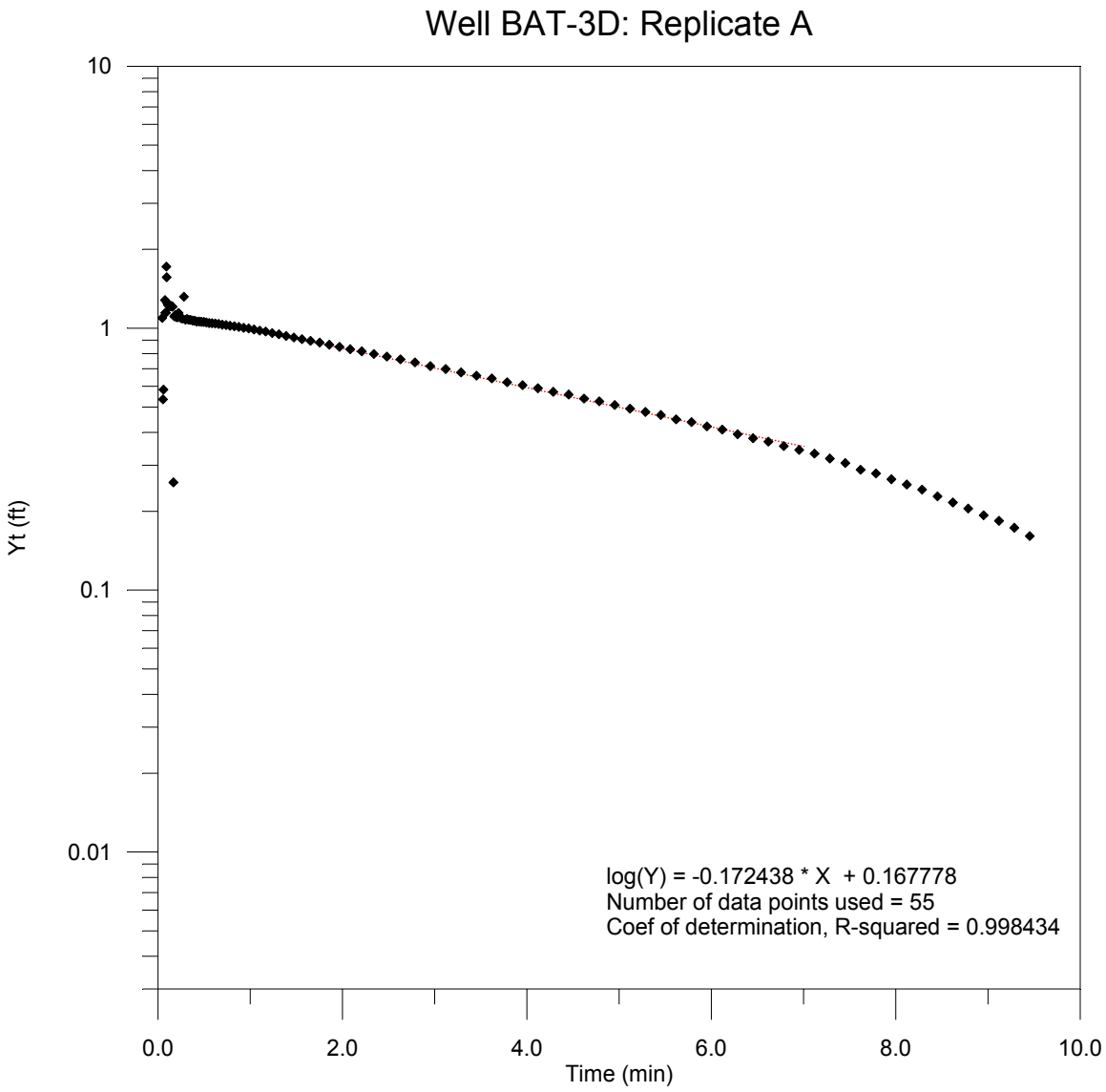
Well	Predemo	Postdemo	Ext. Mon.	Change	Response
BAT-3D	1.3	(26.4)	(65.8)	(increase?)	poor
BAT-3I	1.6	2.4	1.4	negligible	excellent
BAT-5I	6.4	1.5	6.2	negligible	fair
BAT-5S	4.0	5.0	1.5	negligible	good
BAT-6D	2.3	1.4	0.4	negligible	good
BAT-6I	1.4	3.7	1.2	negligible	fair
BAT-6S	5.1	(97.3)	(57.2)	(increase?)	poor

Bouwer, H., and R.C. Rice, 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, v.12, n.3, pp. 423-428.

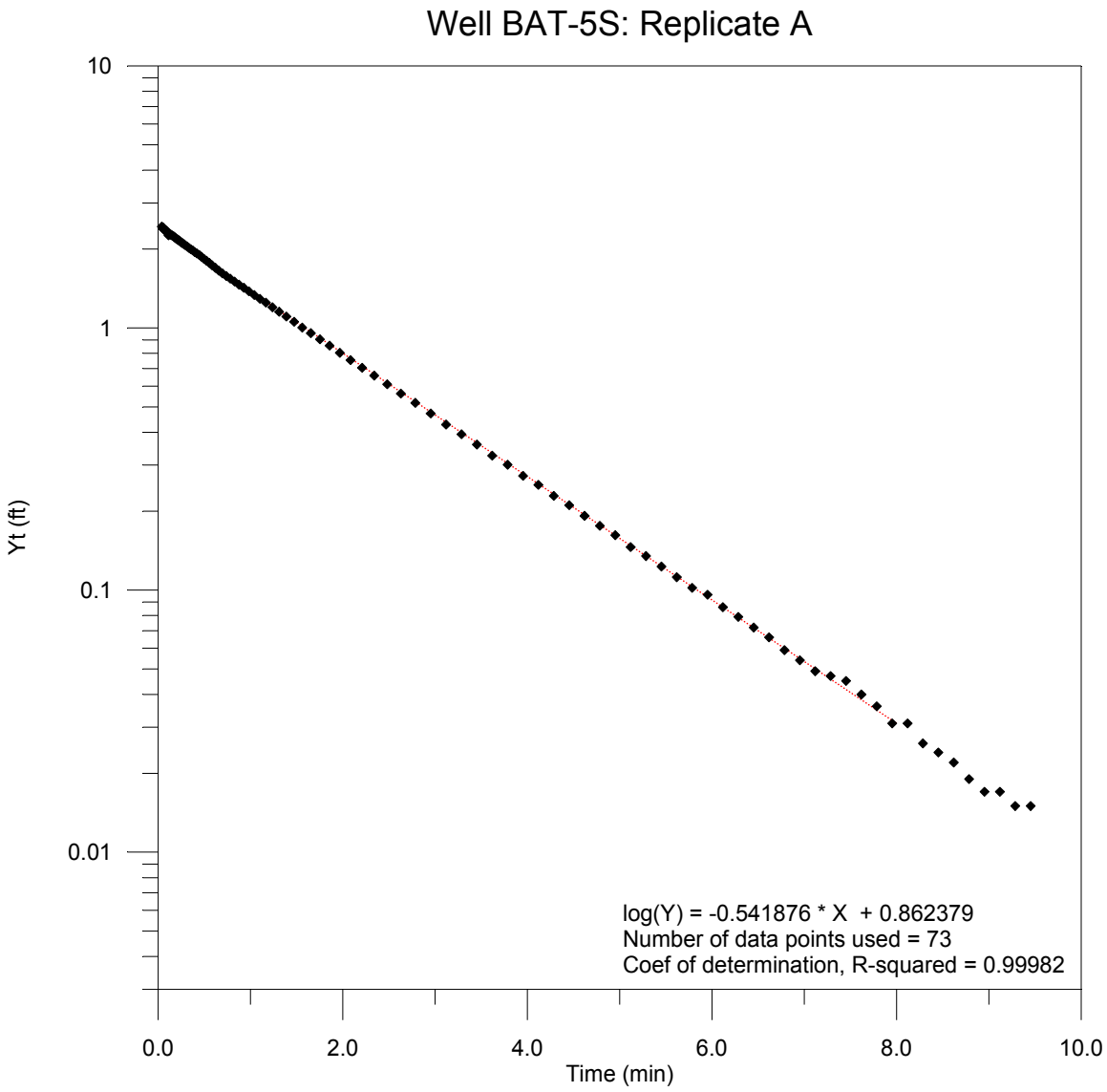
Bouwer, H., 1989, The Bouwer and Rice slug test- an update, Ground Water, v. 27, n.3., pp. 304-309.



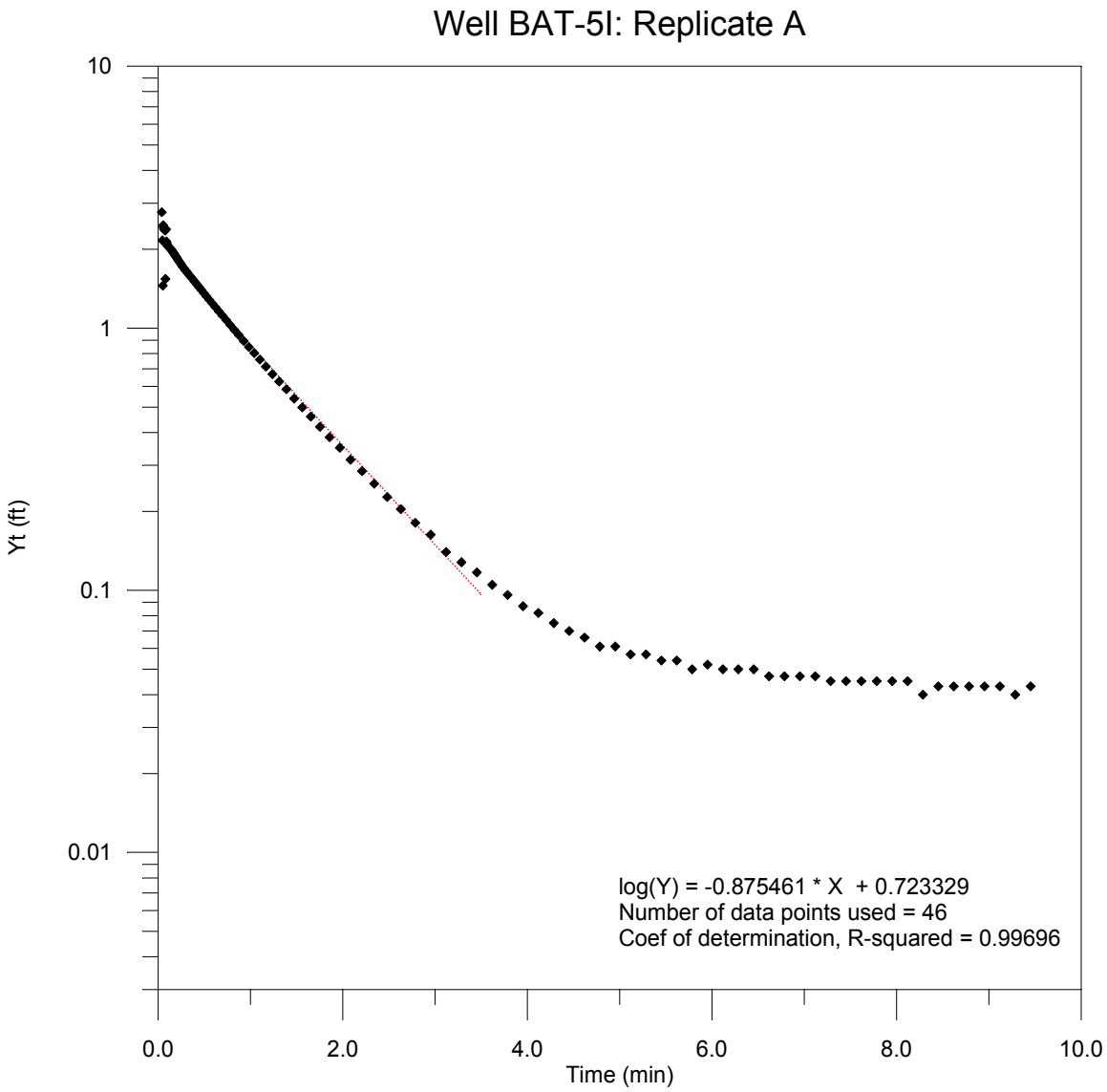
Pre-demonstration Slug Test Results: Well BAT-3I.



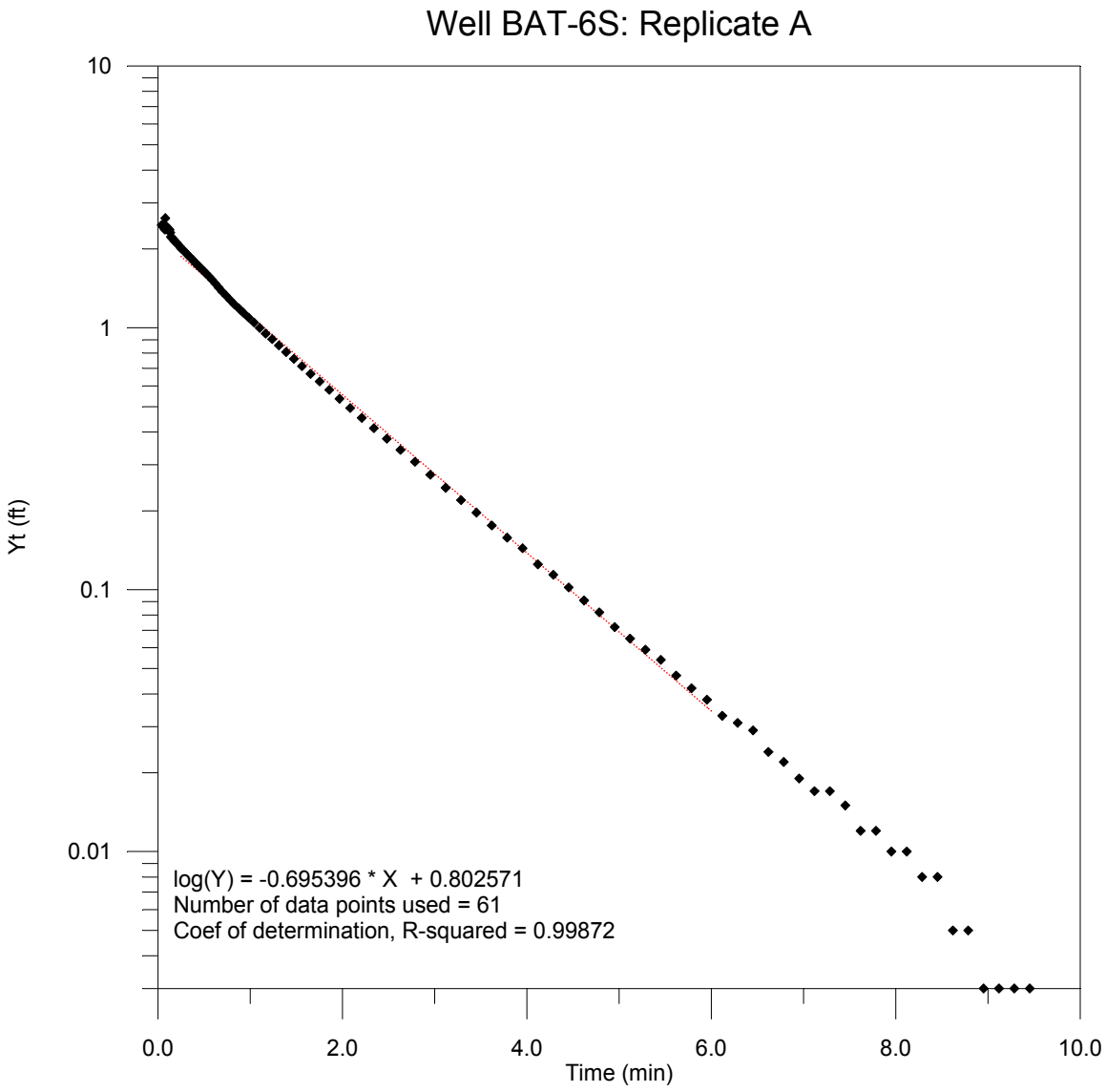
Pre-demonstration Slug Test Results: Well BAT-3D.



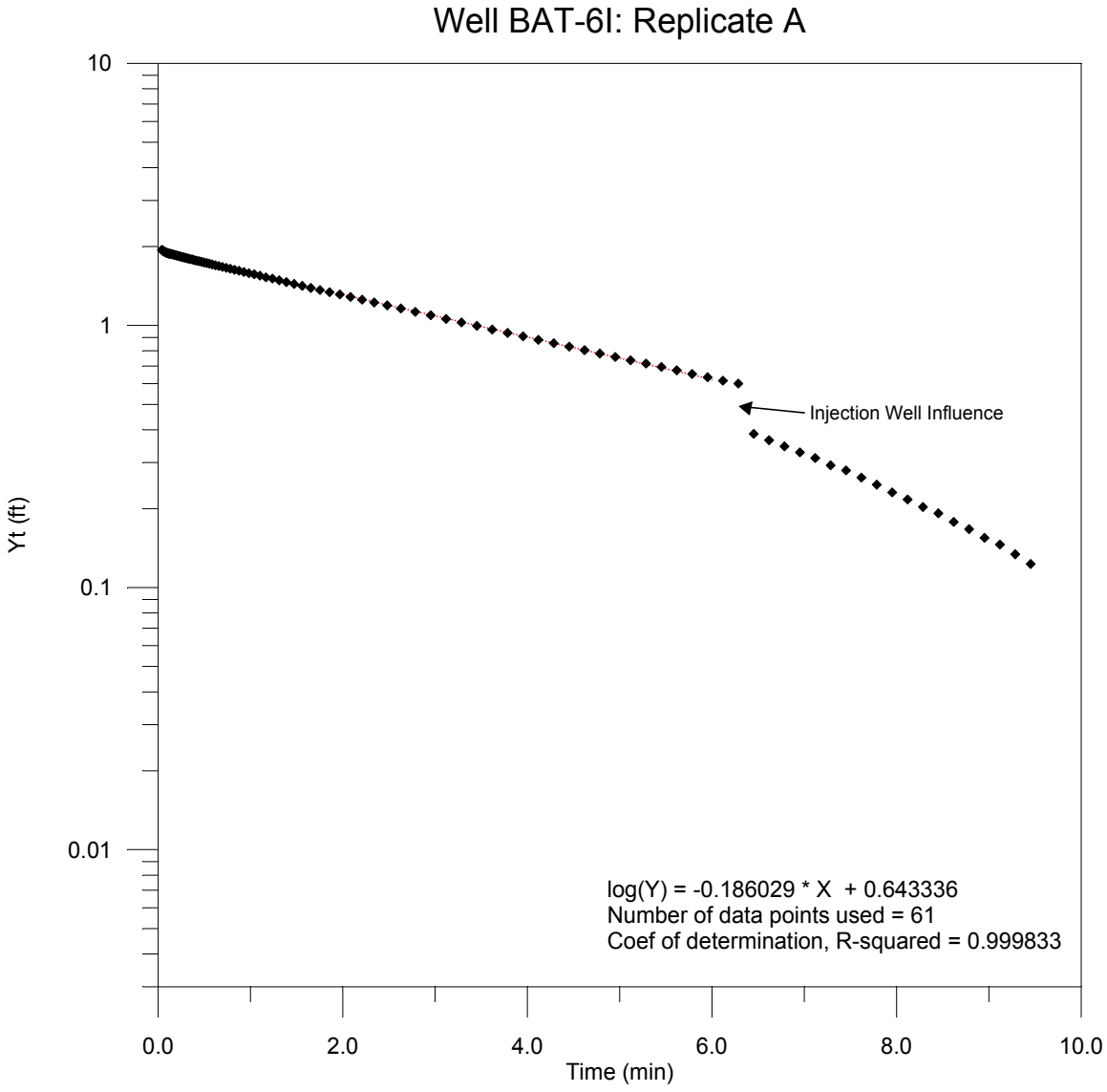
Pre-demonstration Slug Test Results: Well BAT-5S.



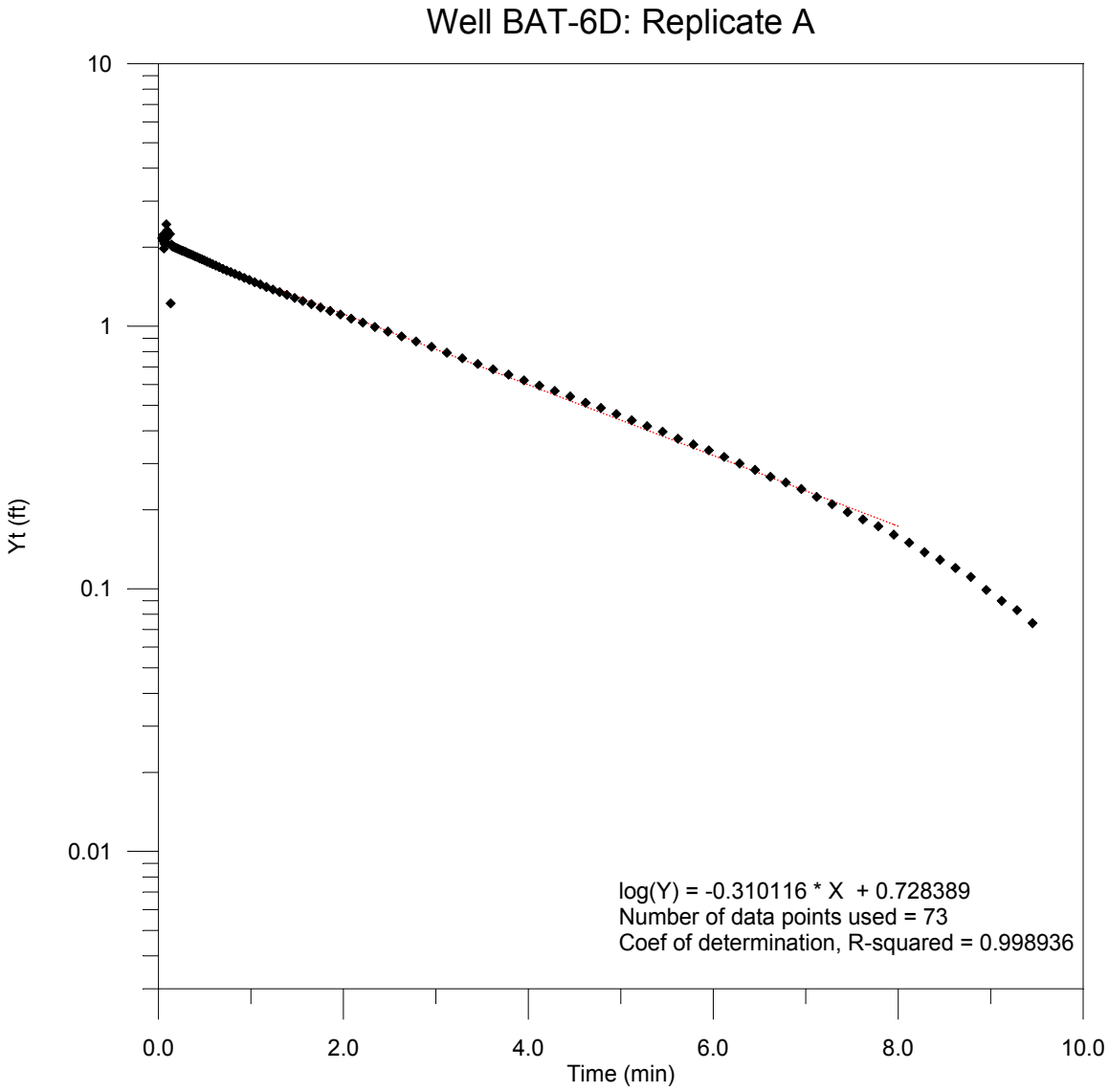
Pre-demonstration Slug Test Results: Well BAT-5I.



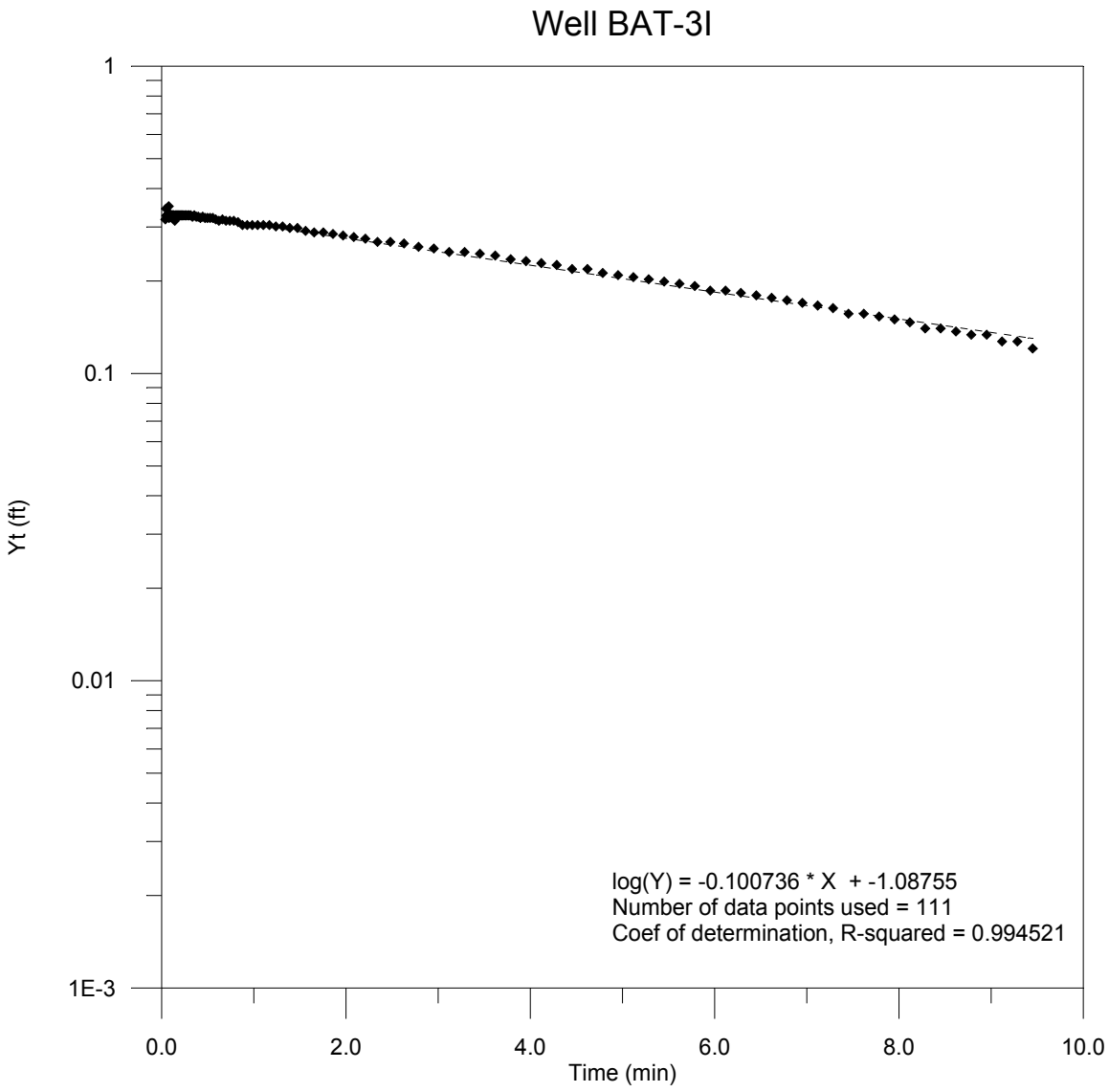
Pre-demonstration Slug Test Results: Well BAT-6S.



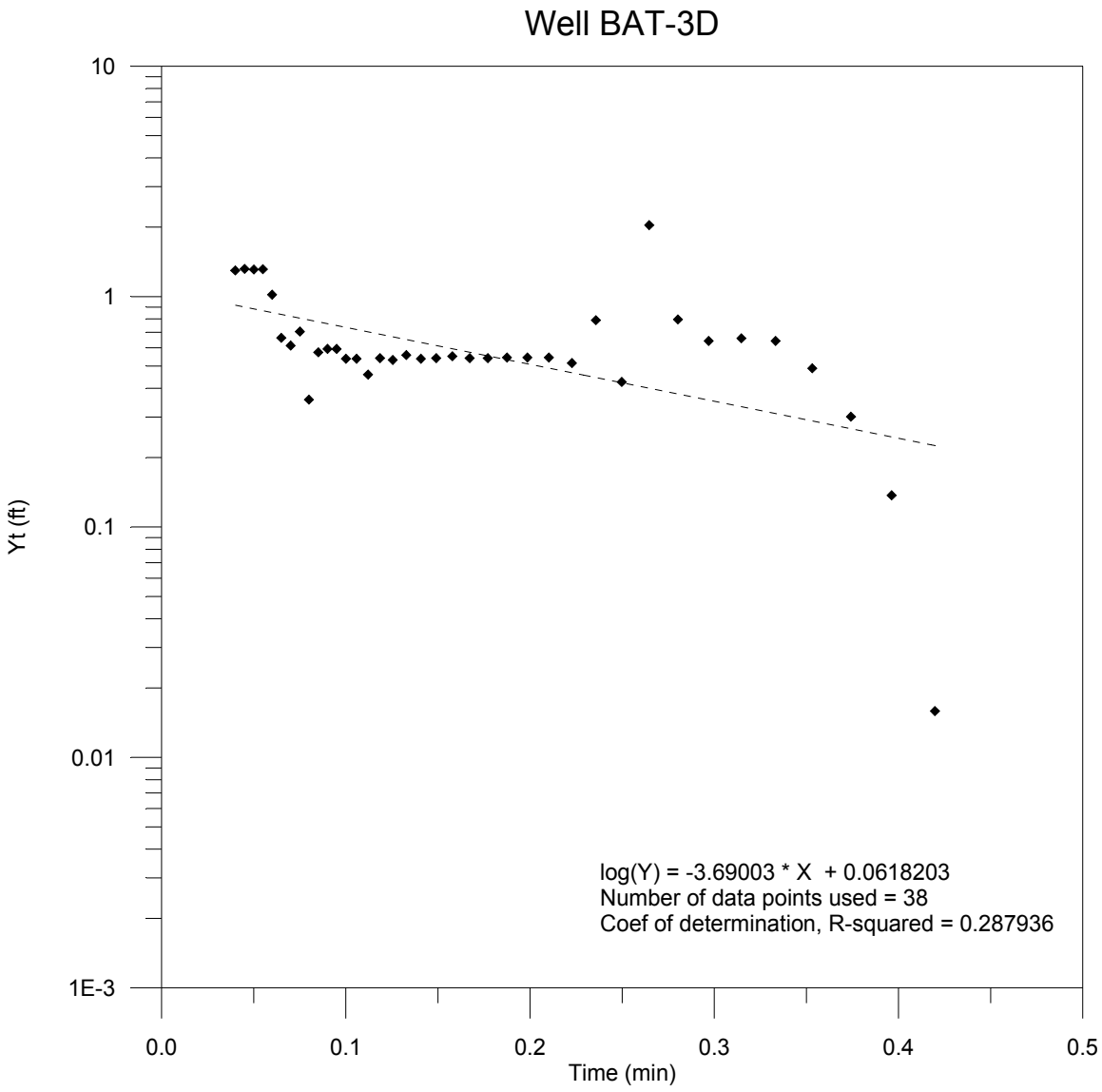
Pre-demonstration Slug Test Results: Well BAT-6I.



Pre-demonstration Slug Test Results: Well BAT-6D.



Post-demonstration Slug Test Results: Well BAT-3I.



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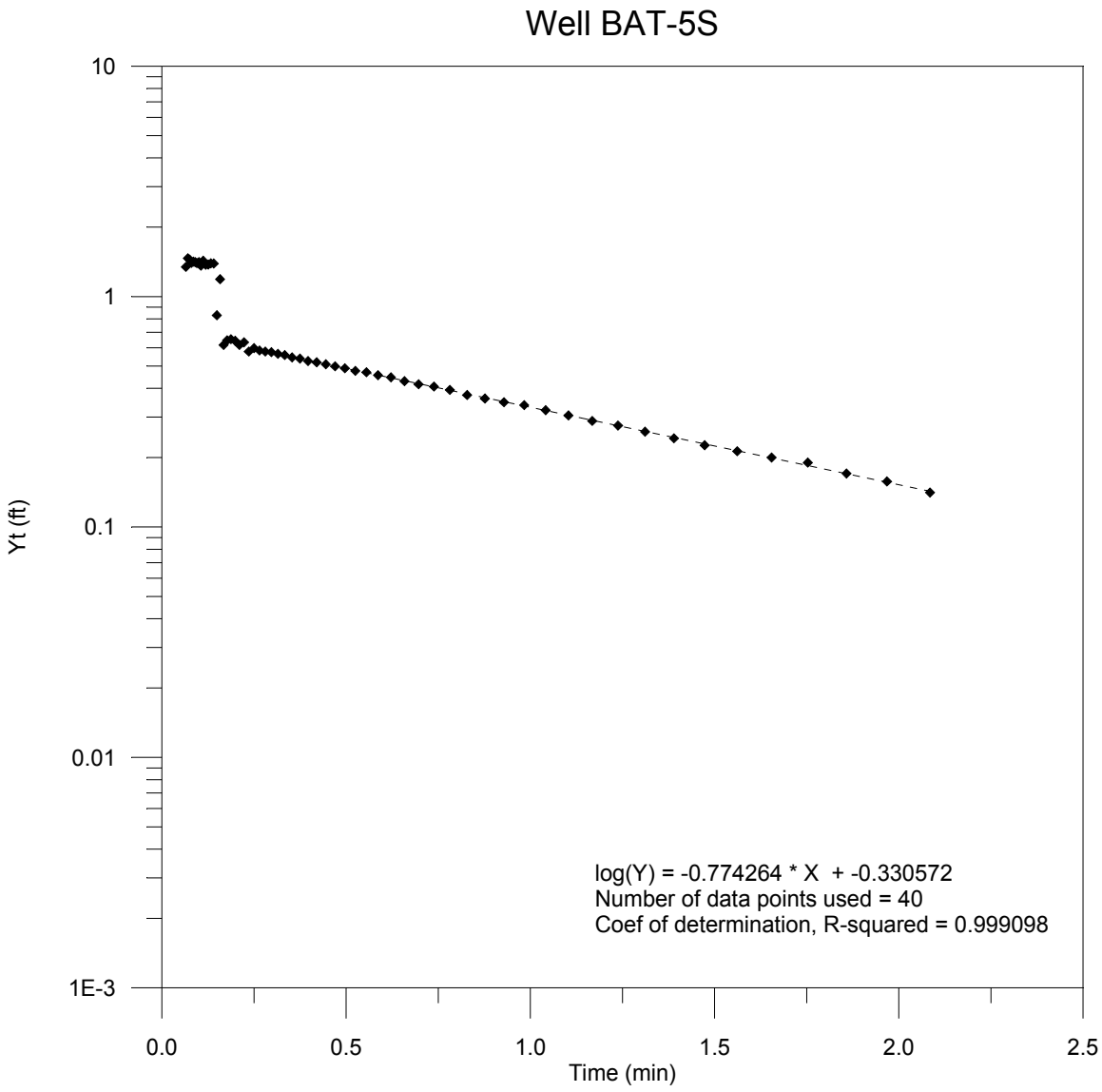

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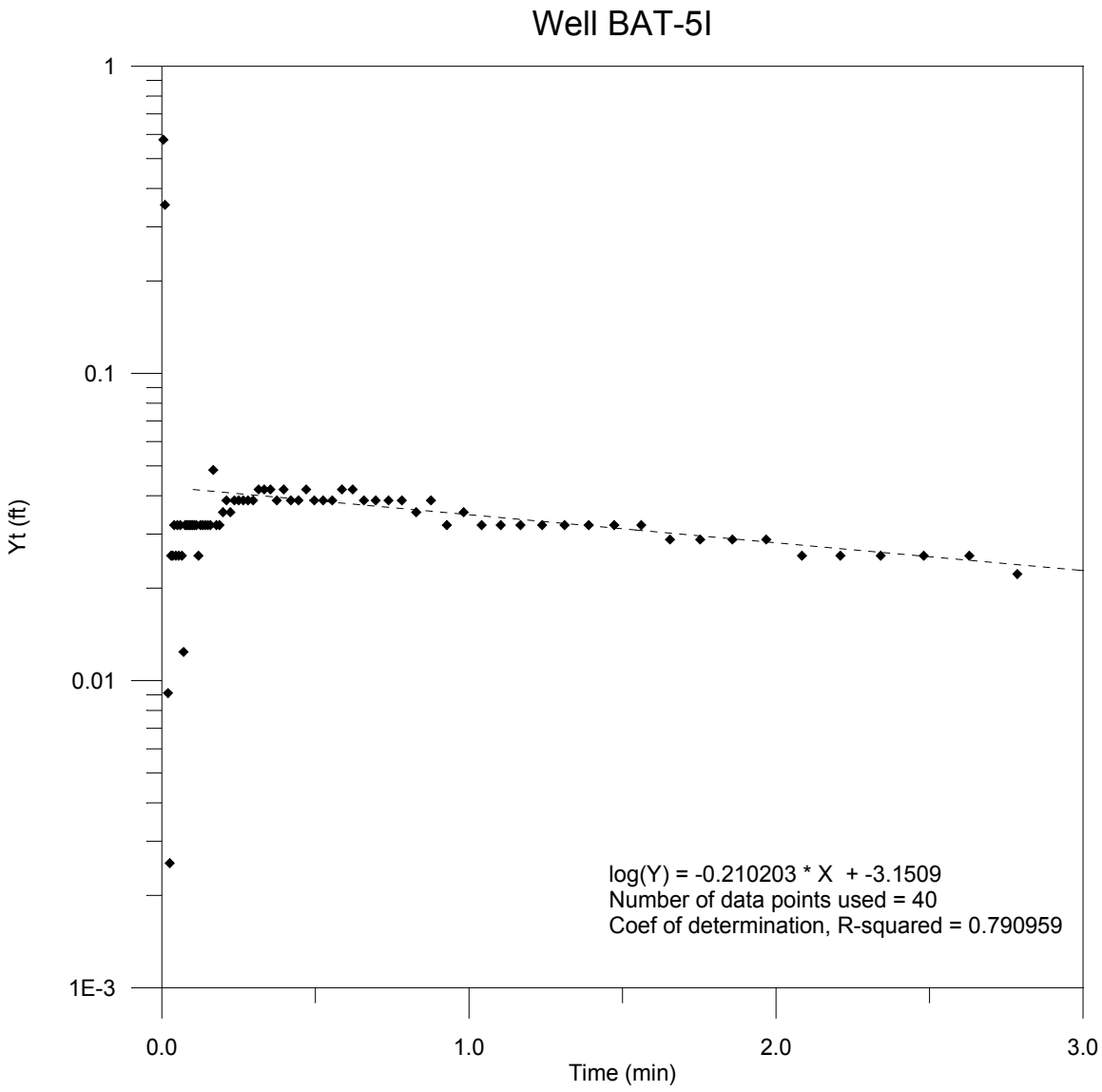

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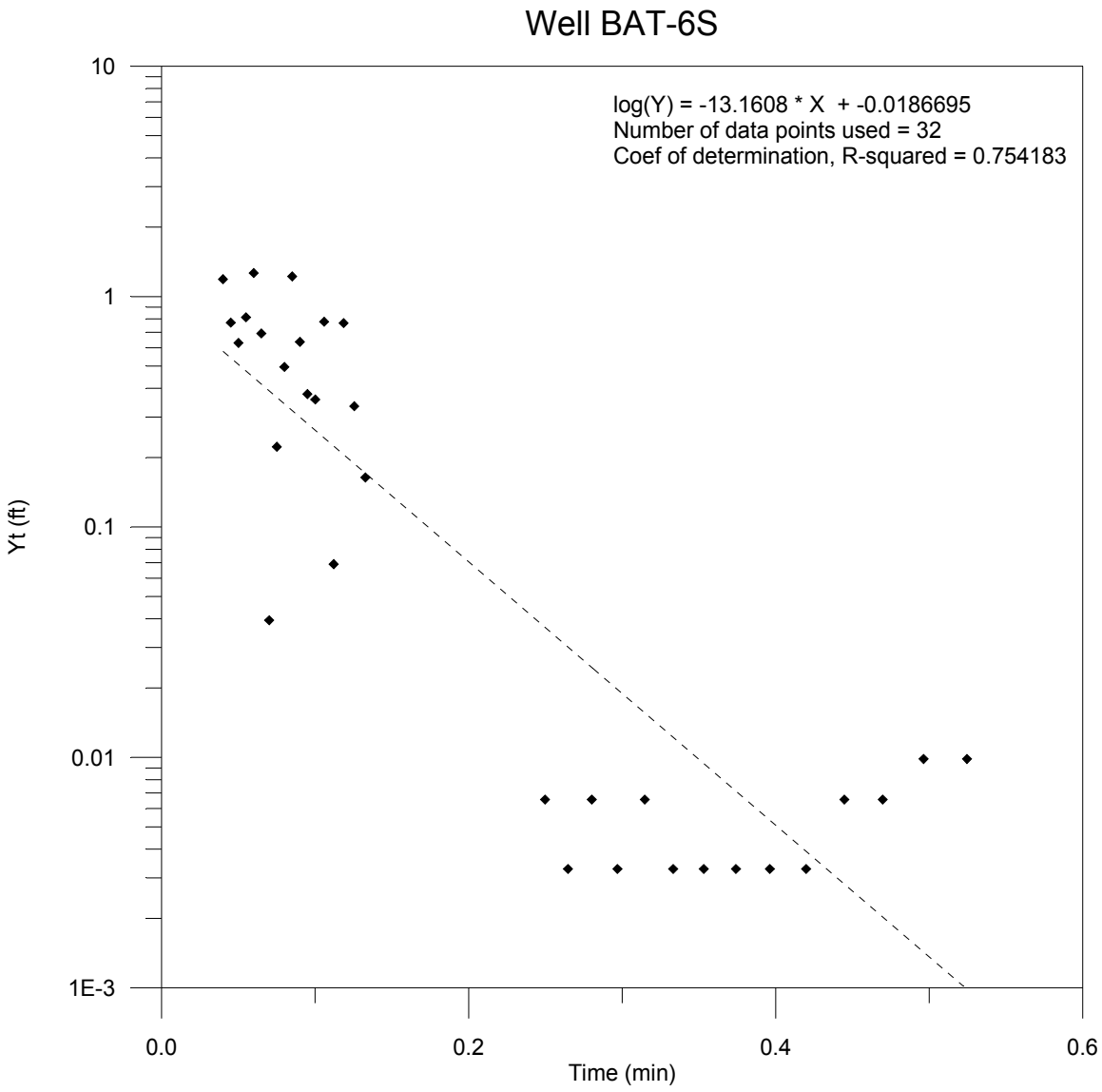
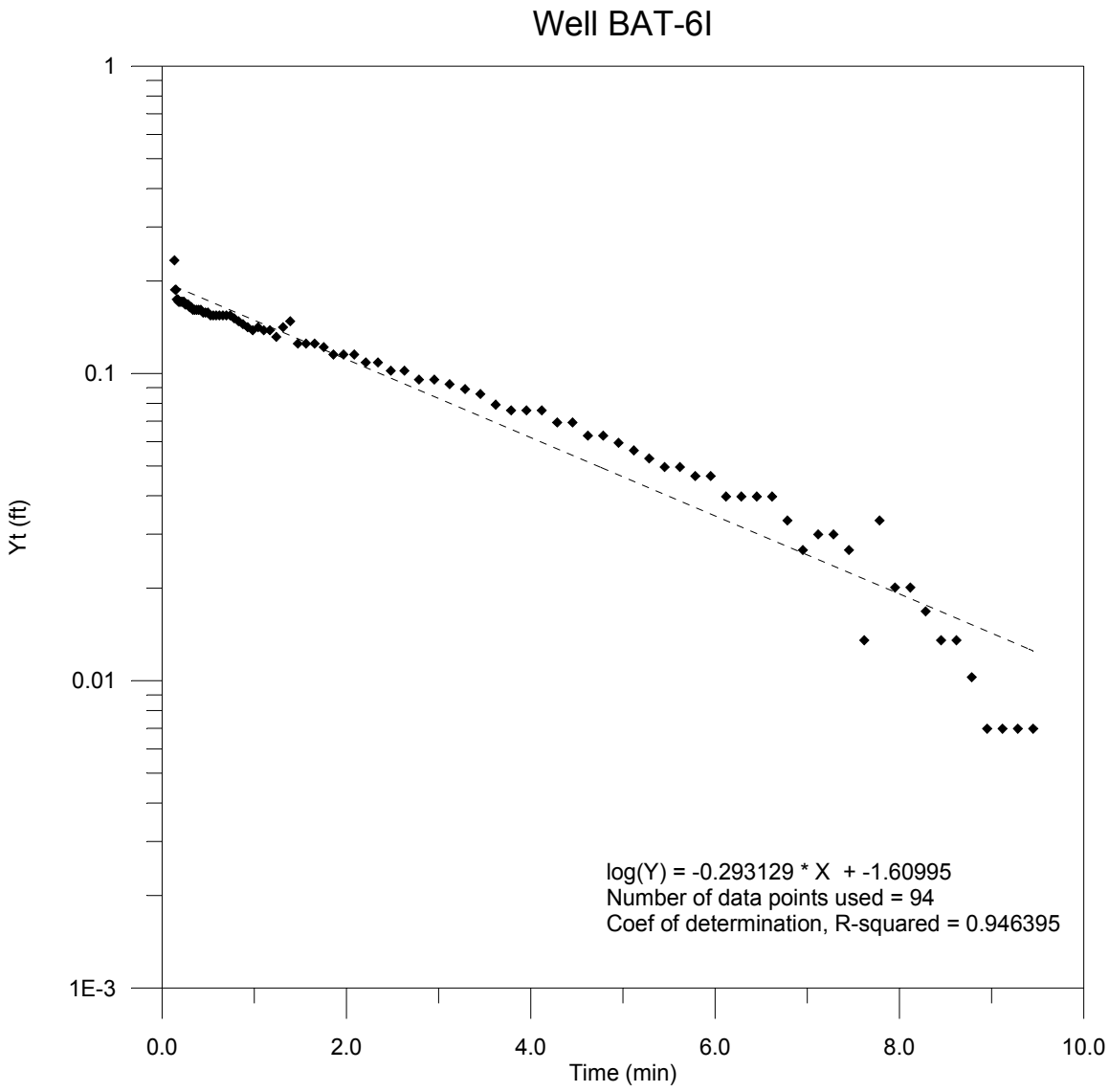
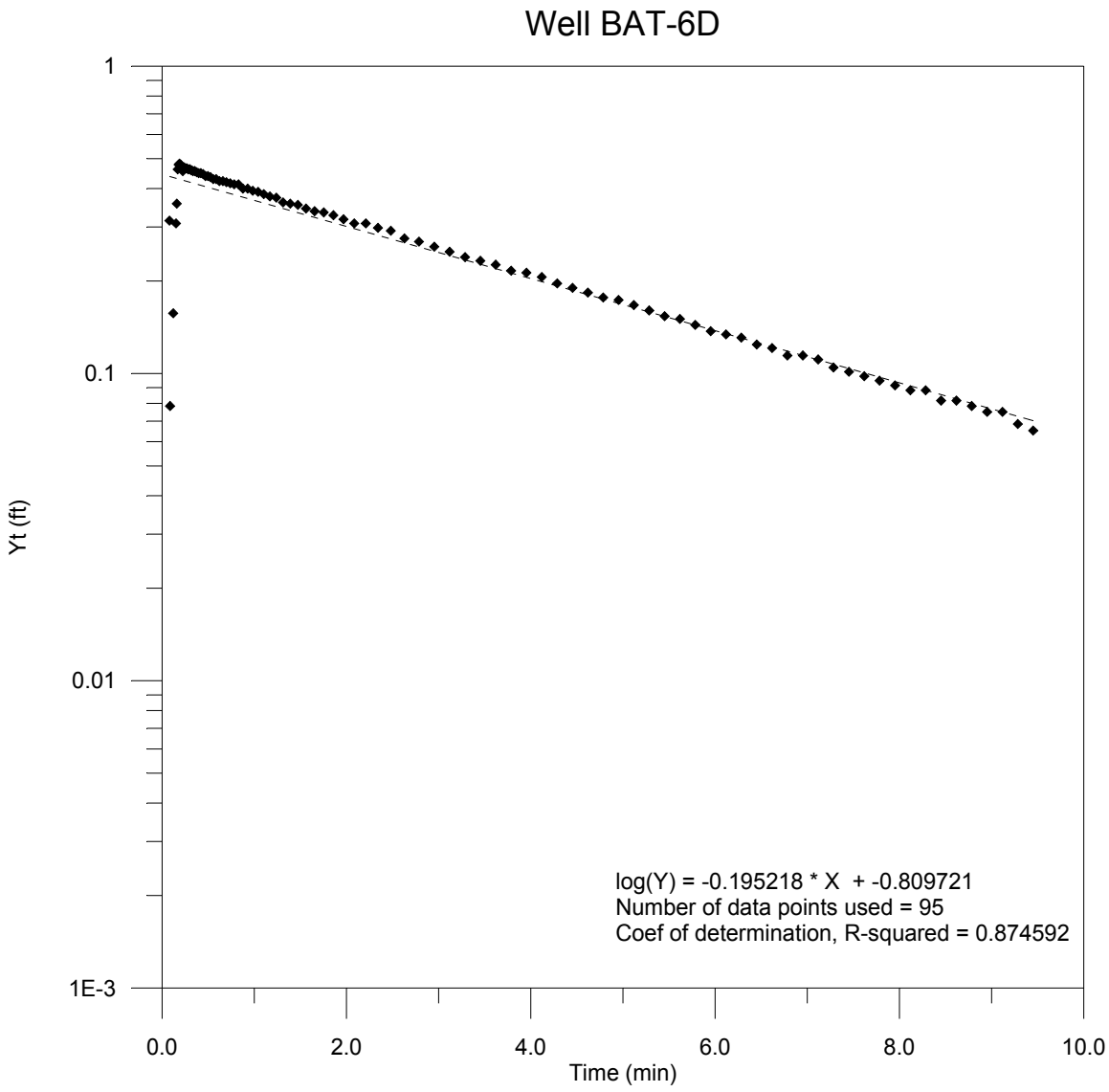


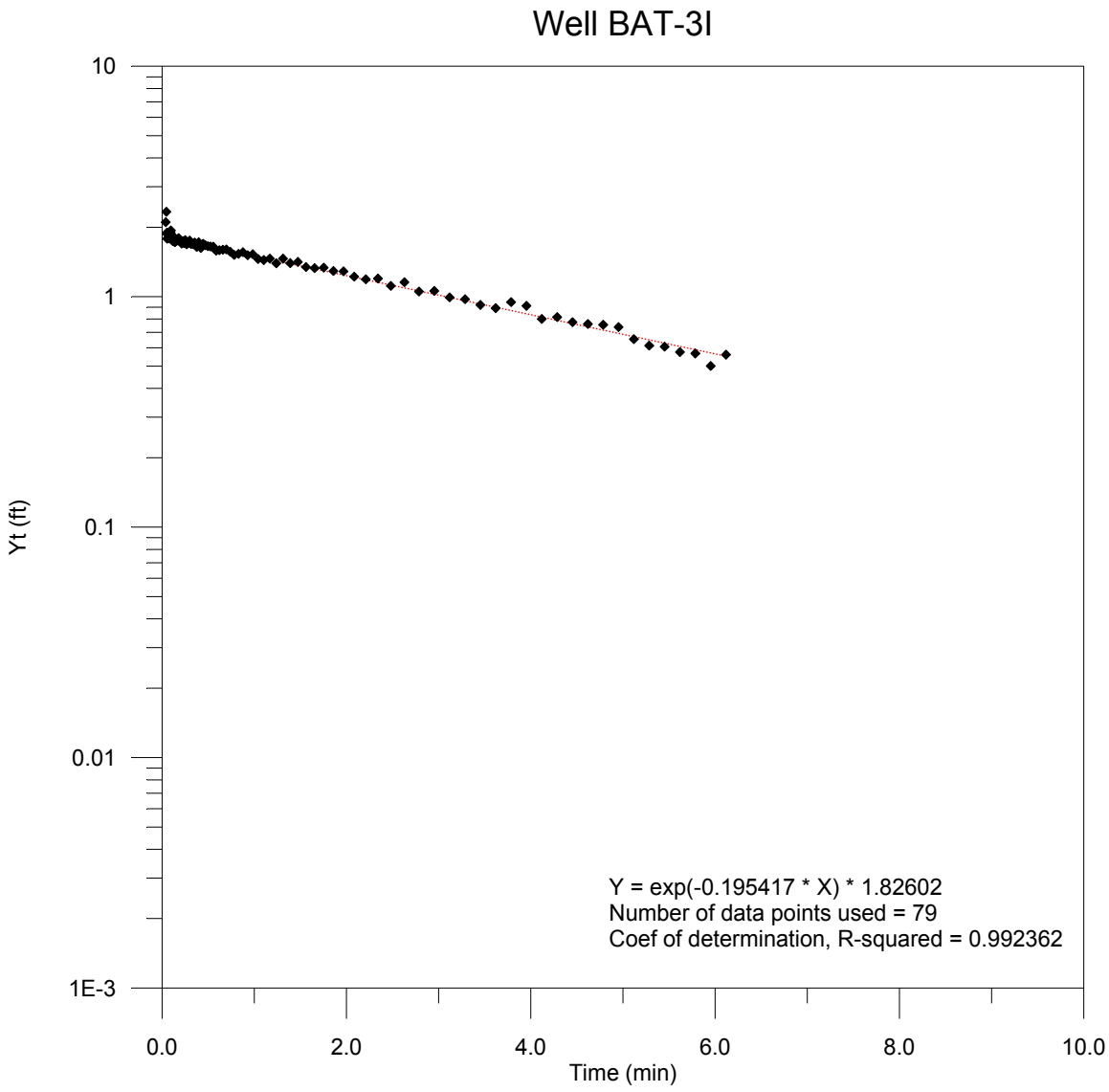
Post-demonstration Slug Test Results: Well BAT-6S.



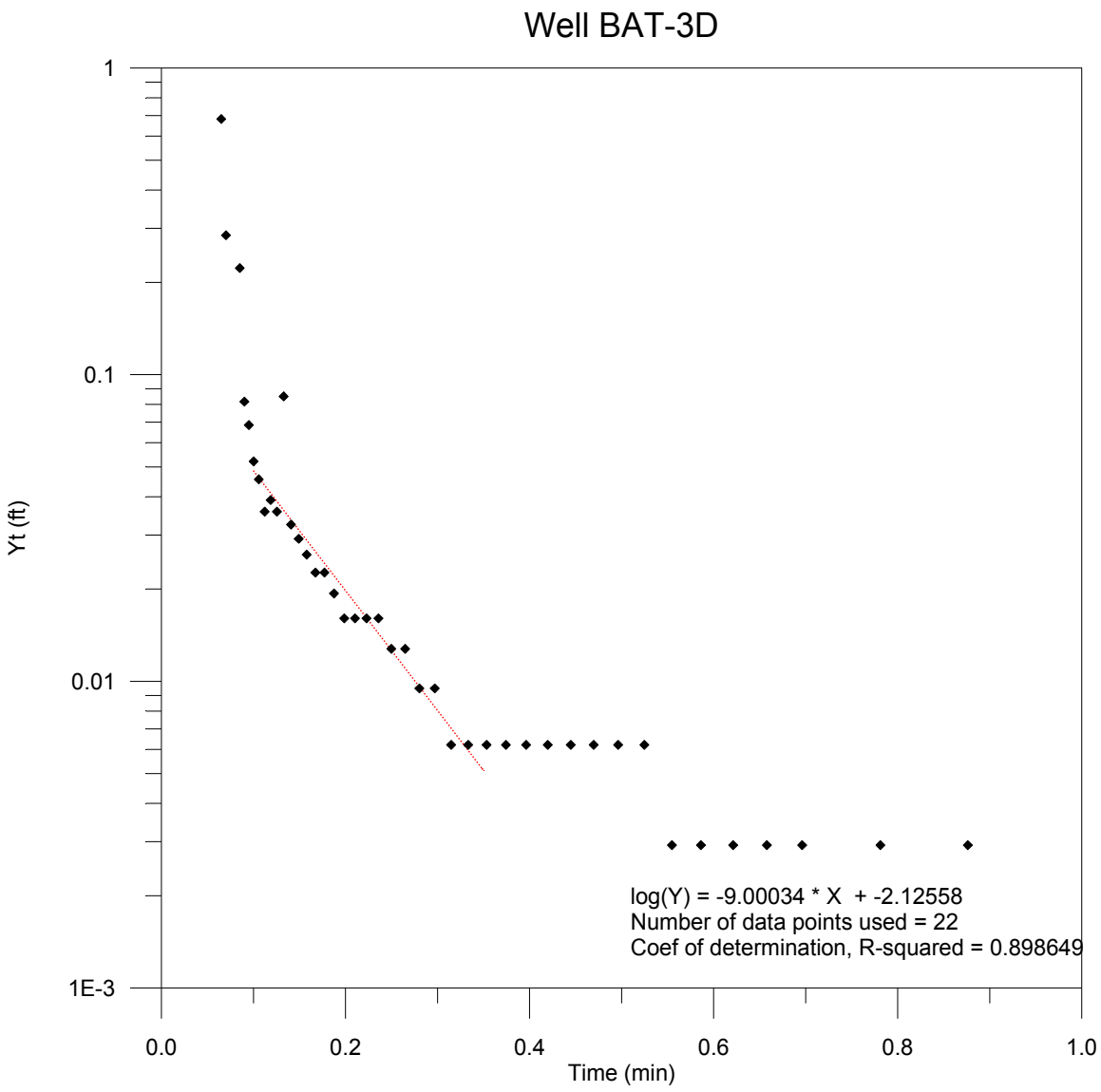
Post-demonstration Slug Test Results: Well BAT-6I.



Post-demonstration Slug Test Results: Well BAT-6D.



Extended Monitoring Slug Test Results: Well BAT-3I.



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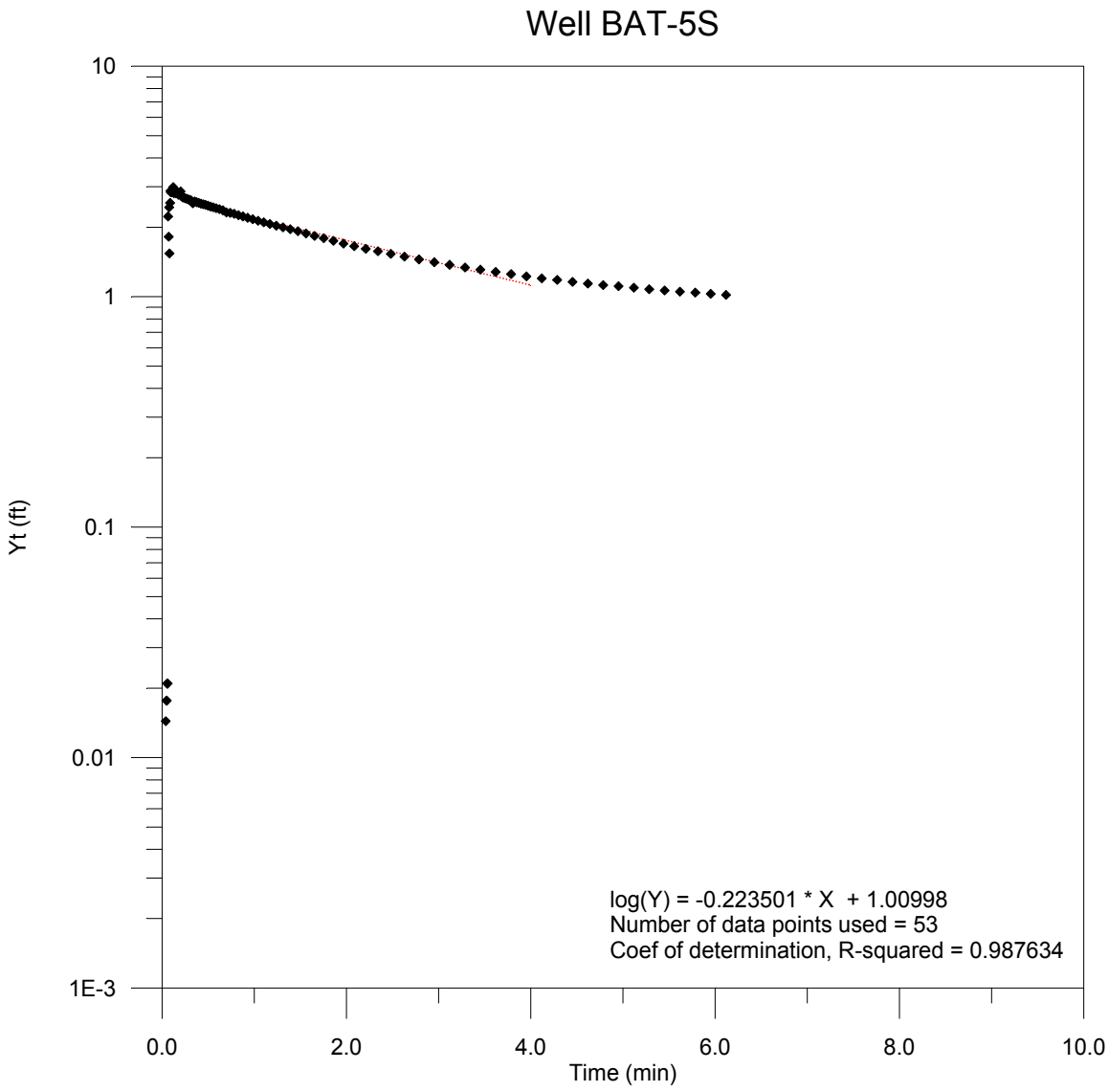

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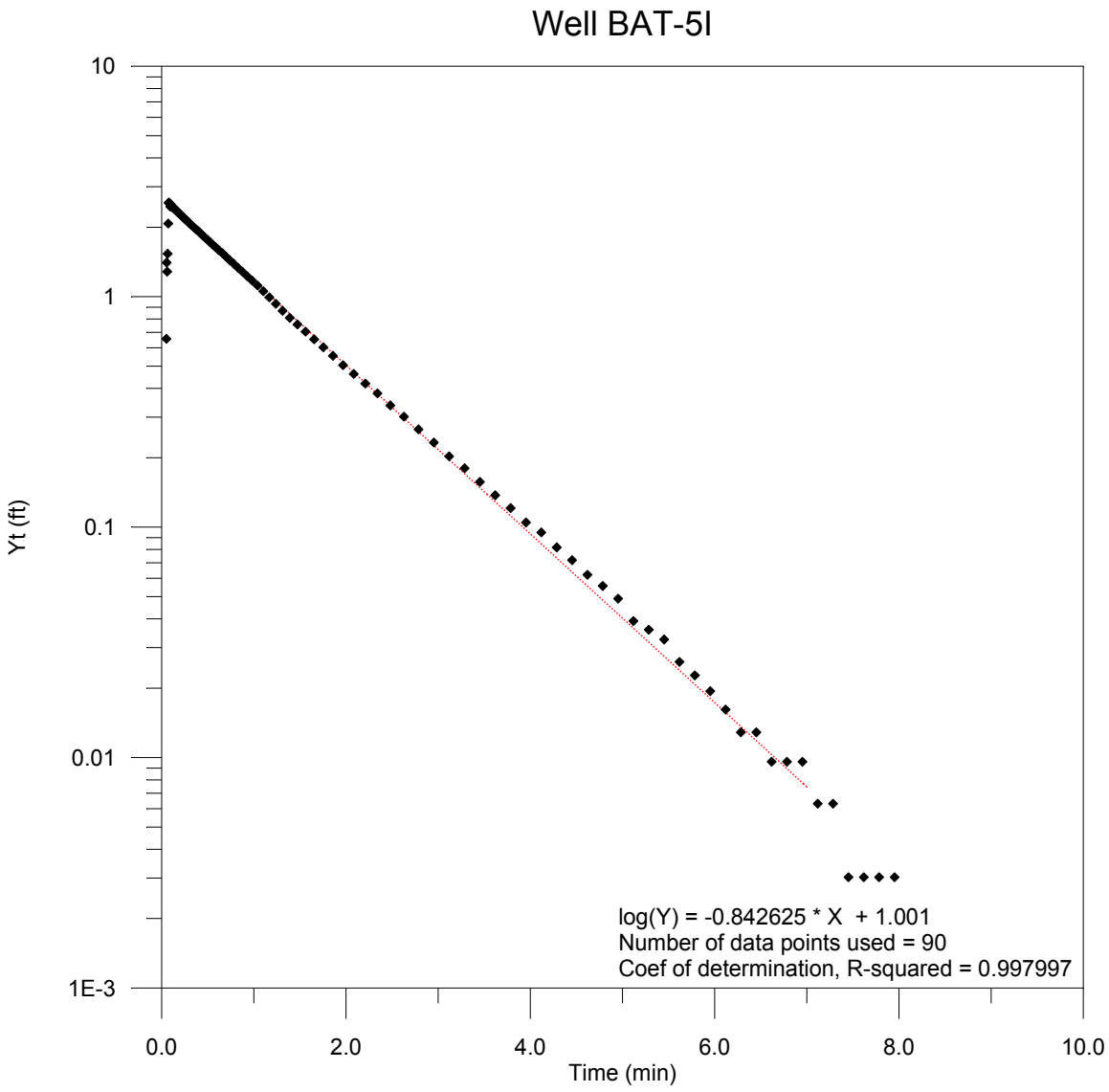
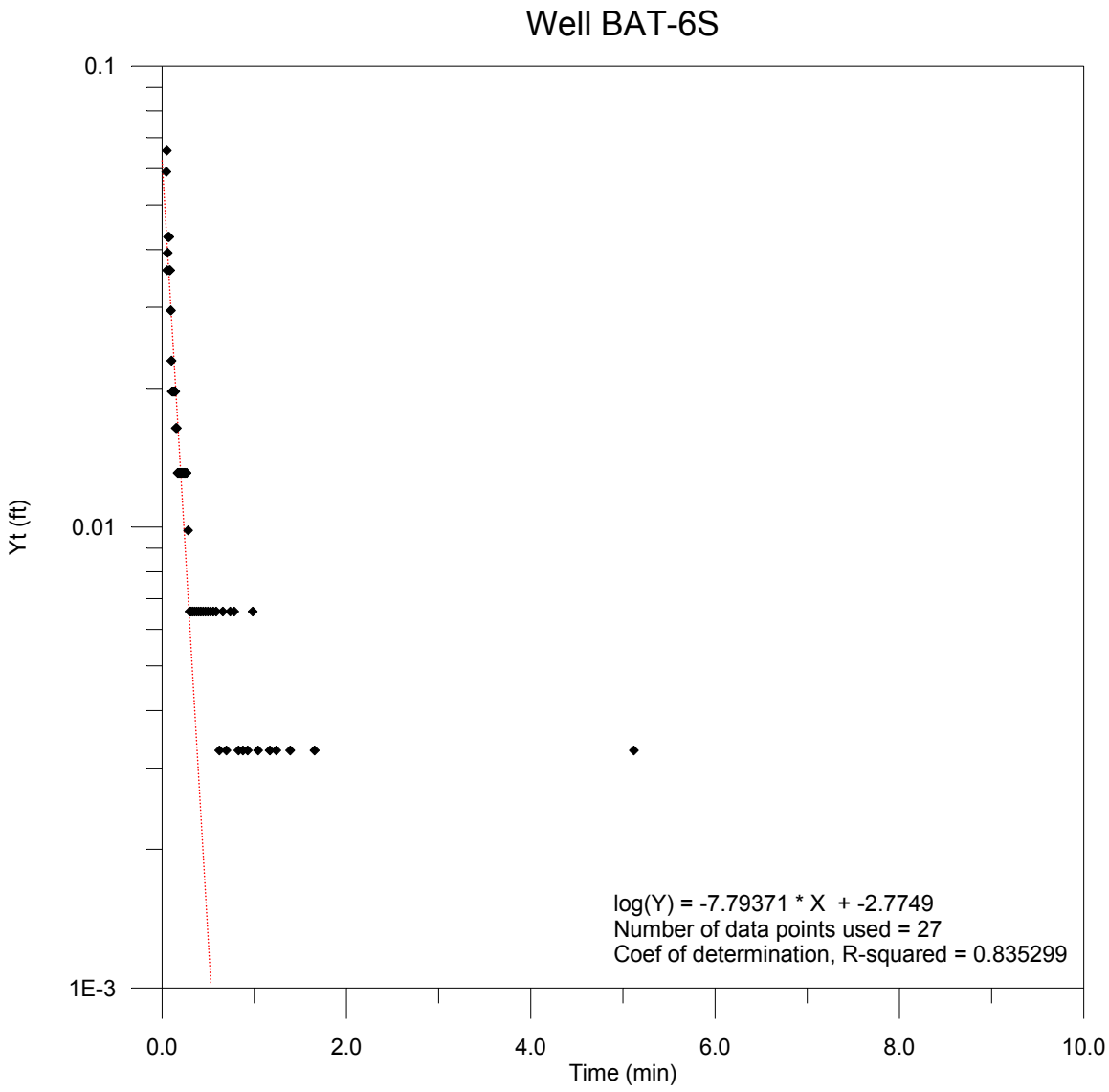


Extended Monitoring Slug Test Results: Well BAT-5I.



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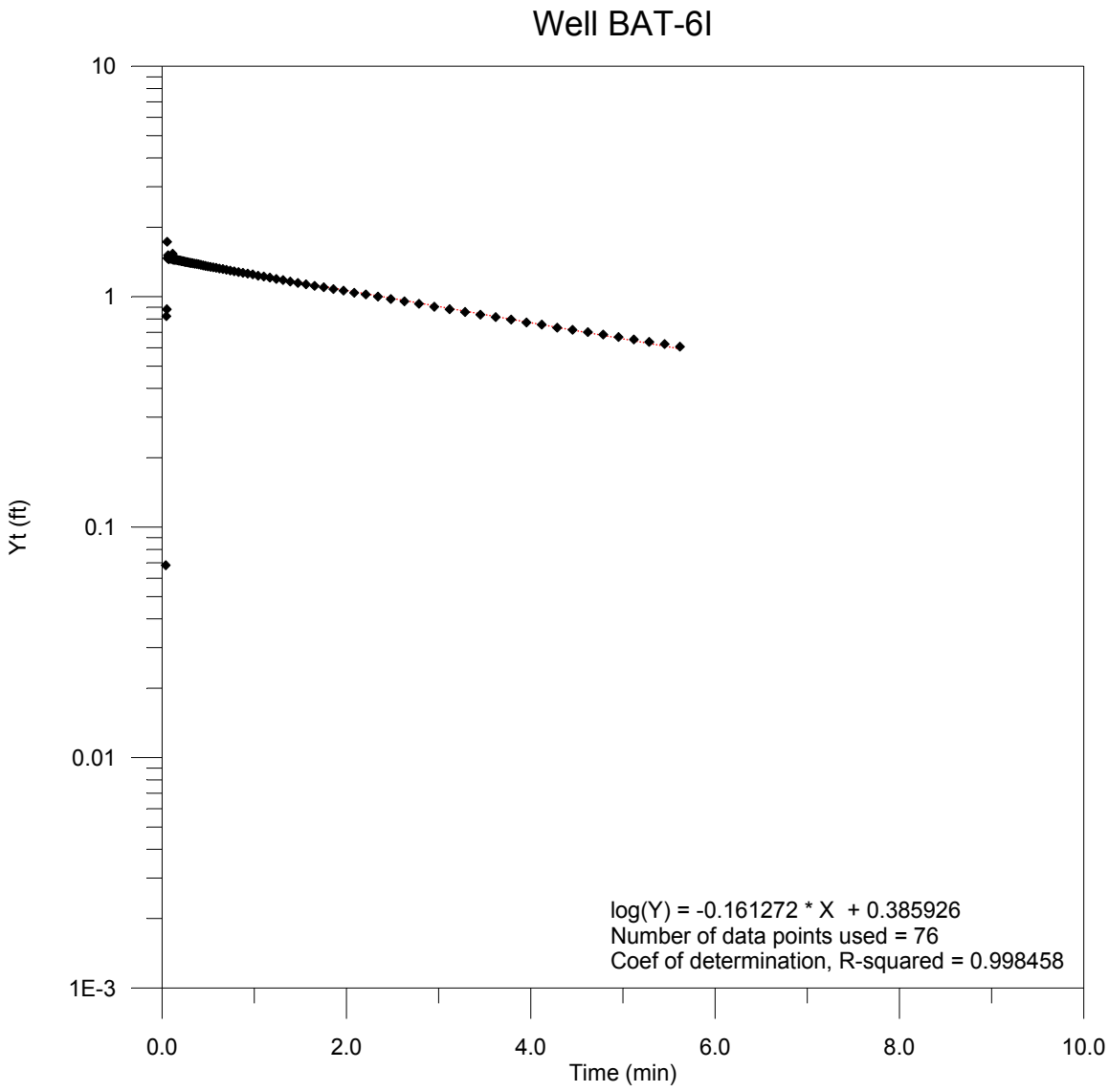
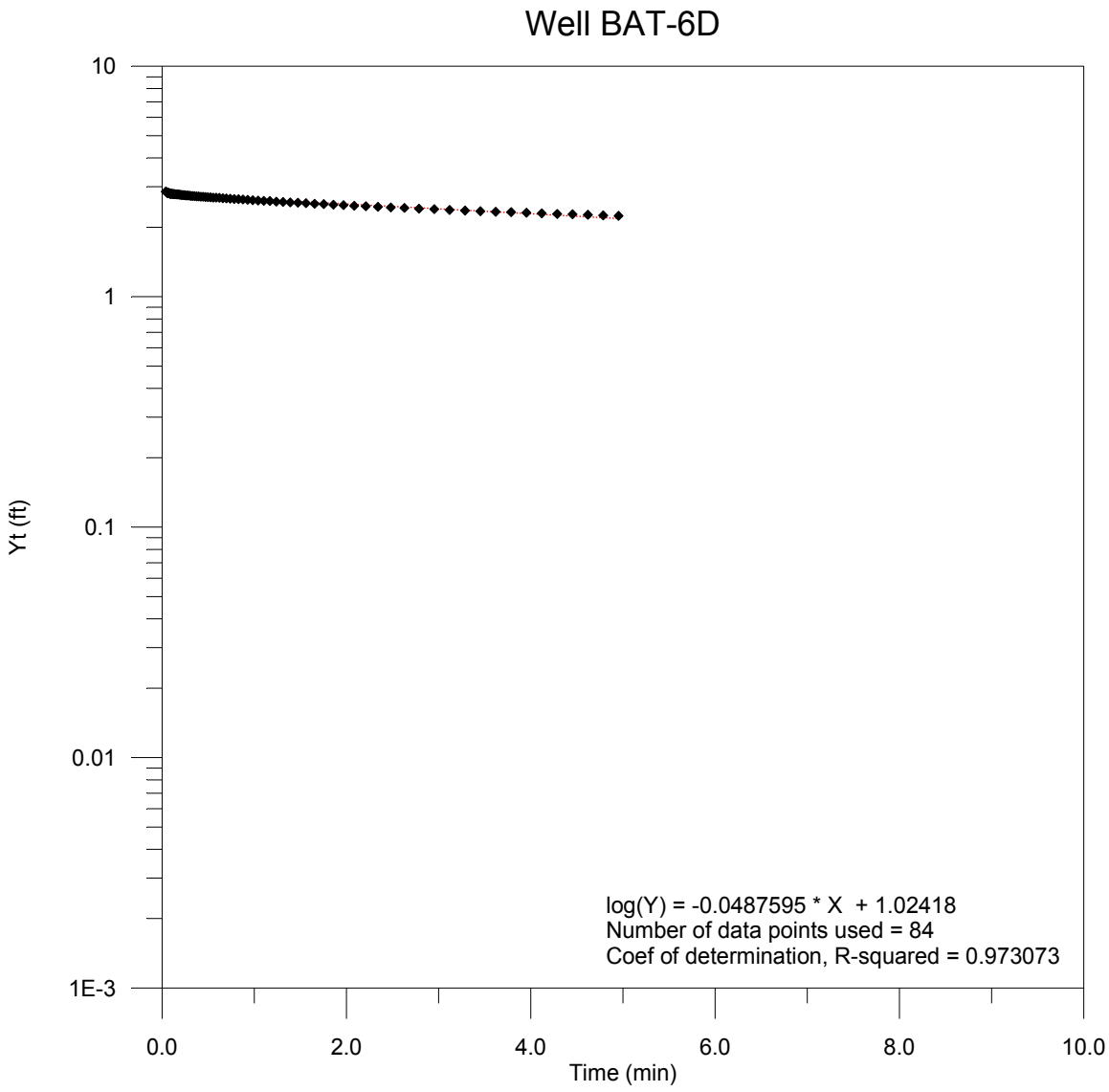
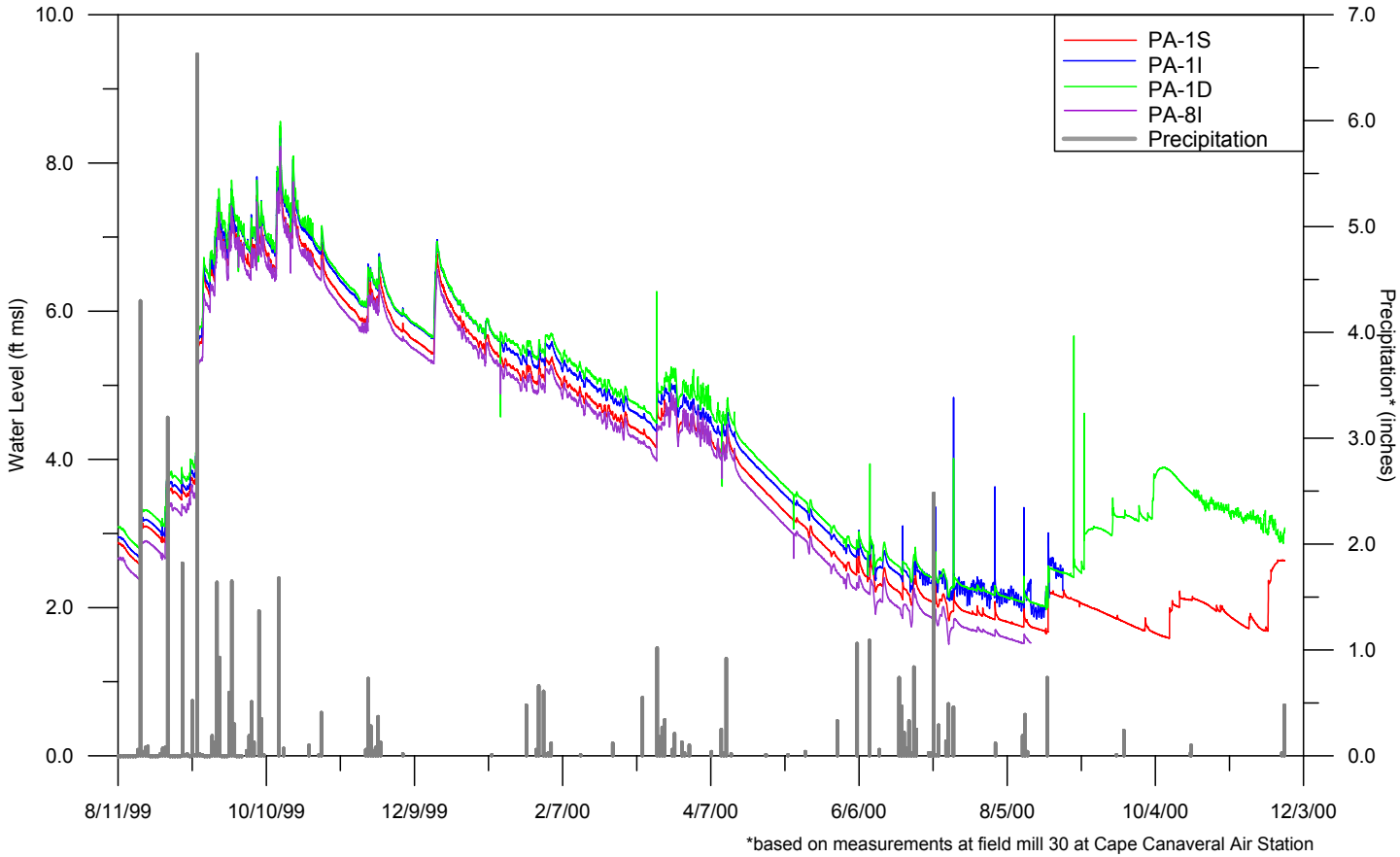


Extended Monitoring Slug Test Results: Well BAT-6I.



Extended Monitoring Slug Test Results: Well BAT-6D.


PA-1S
PA-1I
PA-1D
PA-8I
Precipitation
Water Level (ft msl)
Precipitation* (inches)
10.0
8.0
6.0
4.0
2.0
0.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
8/11/99
10/10/99
12/9/99
2/7/00
4/7/00
6/6/00
8/5/00
10/4/00
12/3/00
*based on measurements at field mill 30 at Cape Canaveral Air Station